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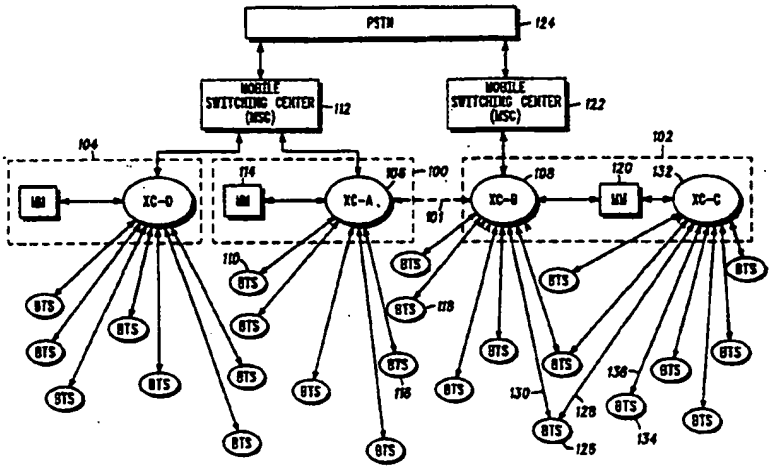

(57) Abstract

A method and apparatus is provided for use in a radio communication system having a first and second base site communication unit (116, 118) operatively coupled to a first and second transcoder (106, 108), respectively. This system also includes a mobile communication unit which is requesting to enter a linked-communication mode with the first and second base site units. In order to perform a linked-communication, a transcoder-base site interface link is established between the second base site and the second transcoder. In addition, the second transcoder is configured to operate in a bypass mode such that it relays information within the transcoder-base site interface link through a communication across regional entity (CARE)-Link in conjunction with a CARE-Control-Link between the first and second transcoder. Finally, the first transcoder is configured to operate in linked-communication mode by relaying information within the CARE-Link which is controlled by the CARE-Control-Link.

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COMMUNICATION ACROSS REGIONAL ENTITIES

Related Inventions

The present invention is related to the following invention which is assigned to the assignee of the present invention. Method and Apparatus for Passing Network Device Operations Between Network Devices by Bonta having U.S. Serial No. 08/123,615, and filed on September 17, 1993.

Field of the Invention

The present invention relates to communication systems having a plurality of transcoders and, more particularly, to a method and apparatus for communication across regional entities in a communication system.

Background of the Invention

The following description is directed for use in a direct sequence code division multiple access (DS-CDMA) communication system. One such DS-CDMA system is described in the communication standard

known as IS-95 or "Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular System" as well as IS-96 or "Speech Service Option Standard For Wideband Spread Spectrum Digital Cellular System" and published by the Telecommunications Industries Association (TIA), 2001 Pennsylvania Ave, N.W., Washington, D.C. 20006. However, it will be appreciated by those skilled in the art that the principles taught herein can readily be extended to other types of communication systems including but not limited to frequency division multiple access (FDMA) and time division multiple access (TDMA) communication systems.

Referring now to FIG. 2, because DS-CDMA cellular communication system equipment typically has an inherent limit on the number of communication channels that can be supported by each transcoder/selection system entity (XC), seams **200** form between the cells (e.g., cell 1 and cell 4) supported by different regional transcoder/selection entities (e.g., XC system A **106** and B **108**, respectively). Each transcoder/selection entity exchanges speech information with voice coding devices (i.e., vocoders) and other communication network devices higher up in the system hierarchy (e.g., a mobile switching centers (MSC) or the public switched telephone network (PSTN)). In addition, each transcoder/selection entity eliminates copies (by discarding or combining) of frames of voice traffic information. Copies may exist at the transcoder/selection entity, because a frame may have traveled along two or more signaling paths through a cellular infrastructure before reaching the transcoder. Each transcoder/selection entity also notifies vocoders of bad or missing frames (e.g., due to a signaling blank and burst operation). Finally, each transcoder may also duplicate frames for simultaneous transmission to multiple base transceiver stations (BTS).

One method to handoff across the seam **200** utilizes a hard handoff instead of soft handoff (i.e., the soft handoff technique described in IS-95). In a hard handoff, a mobile communication unit is instructed to change to a completely new set of pilot channels which implies that no diversity selection function can be accomplished during the transition from the old transcoder/selection entity to the new one.

However, it is desirable to perform a soft handoff across the seam. Soft handoff (SHO) maintains the benefits of a smooth transition

even while passing operations across the seam **200** between a source to target transcoder/selection regional entity. These benefits include providing potential signal receiver gains by adding diversity paths. It will be appreciated by those skilled in the art that the source and target transcoder may be located proximate one another in a central site location scheme or remotely located from one another in a distributed site location scheme. Whenever a transition is made (i.e., the source cell drops out of a soft handoff connection), "ownership" of the call is passed on to one of the target cells' controller (i.e., a link and call management device) and associated transcoding/selection entity. The target cell's controller receiving the ownership then becomes the source cell controller, and makes all subsequent decisions regarding soft handoff until it drops out. Therefore, a need exists for a method implementing such a desirable soft handoff across a transcoder seam **200**.

Summary of the Invention

These needs and others are substantially met through provision of a method and apparatus for use in a radio communication system having a first and second base site communication unit operatively coupled to a first and second transcoder, respectively. This system also includes a mobile communication unit which is requesting to enter a linked-communication mode with the first and second base site units. In order to perform a linked-communication, a transcoder-base site interface link is established between the second base site and the second transcoder. In addition, the second transcoder is configured to operate in a bypass mode such that it relays information within the transcoder-base site interface link through a Communication Across Regional Entity Link (CARE-Link) in conjunction with a CARE-Control-Link between the first and second transcoder. Finally, the first transcoder is configured to operate in linked-communication mode by relaying information within the CARE-Link which is controlled by the CARE-Control-Link.

Brief Description of the Drawings

FIG. 1 is a block diagram showing a preferred embodiment communication system having several different transcoder device configurations in accordance with the present invention.

FIG. 2 is a cellular coverage diagram for a communication system operating in accordance with any of the preferred embodiment shown in FIG. 1.

FIG. 3 is a communication flow diagram for adding a handoff setup in accordance with one preferred embodiment transcoder device configuration shown in FIG. 1.

FIG. 4 is a communication flow diagram for a dropping a handoff setup in accordance with one preferred embodiment transcoder device configuration shown in FIG. 1.

Detailed Description

Shown in FIG. 1 is a preferred embodiment communication system having several different transcoder device configurations in accordance with the present invention. The transcoder/selection entity **100** (i.e., a network device) is a key component to a DS-CDMA system, and as such, infrastructure vendors are all interested in supplying this equipment imbedded in their own system architecture. The architecture consists of having this equipment located between a BTS **110** and an MSC **112** (e.g., transcoder rack **100**, **102**, or **104**). One configuration consists of having the transcoder rack physically located between the BTS **110** and the MSC **112**. Another configuration consists of having the transcoder rack physically adjunct to the MSC and providing additional communication links between the transcoder rack and the BTS through the MSC.

Each transcoder (XC) **106** along with a mobility manager (MM) **114** (collectively referred to as the transcoder rack **100**) provides an interconnection between other components in the communication system. For example, an MSC **112** is located on one side and the BTS's **110** and **116** on the other side of the XC **106**. The XC **106** includes Highway Span interfaces, switching functions, shelf controllers, and CDMA unique functions. The interface/controller cards in the XC

frame **106** are configured around a time division multiplexed (TDM) bus which carries voice and system message traffic. The heart of the switch fabric is a 4092 port kiloport switch (KSW). Four KSWs can be space switched with kiloport switch extenders (KSWXs). The KSWX supports subrate switching which allows the transcoder/selector **106** to place four sixteen kilo bits per second (16 kbps) encoded channels on one 64 kbps digital span (DS). Fault management information and intra-frame control messages travel on a separate communication application protocol (CAP) bus.

The XC **106** includes one or more transcoder cards (XCDR card). Each XCDR card converts 64 kbps μ-law pulse code modulated (PCM) signals into encoded voice and vice versa (e.g., this encoded voice may preferably be coded according to IS-96). The XCDR card exchanges encoded voice and PCM with other cards in the transcoder rack **100**, i.e., encoded voice to the KSW for routing to the proper BTS and PCM with an interface card, via the TDM bus (i.e., the backplane). Its primary functions encompass soft handoff (SHO) support (i.e., transcoder selection), voice coding, and message processing to sub-multiplex control message information to a physical layer stream under the MM direction via a CAP interface.

The Supercell Transcoder/Rate Adaptor Unit (STRAU) produces 20 millisecond (ms) frames which are transferred at a 16 kilobits per second (kbps) rate using a modified RA1 rate adaptation format specified in CCITT V.110 as well as the RA2 rate adaptation format specified in CCITT I.460 (which is available from Comite Consultatif International Telegraphique Et Telephonique (CCITT) now known as International Telecommunication Union - Telematic Services (ITU-TS), Place des Nations, CH 1211 Geneve 20, Switzerland). The modified RA1 rate adaptation format consists of 320 bits wherein 260 are used for information traffic (13 kbps), 21 (1.05 kbps) for control, 35 (1.75 kbps) for frame synchronization, and four for time alignment.

In the DS-CDMA implementation, a XCDR outputs 160 bits and appends 11 parity check bits. This leaves an excess of 7.45 kbps of the 13 kbps total at these times, while at the low end the excess rises to 12.2 kbps (16 bits out of the XCDR every 20 ms - no parity).

The XCs send these STRAU frames to each BTS through the KSW switch and TDM Bus which then connects them to appropriate

MSIs (multiple Serial Interface Boards) which provide the T1 link(s) to a BTS. For communications originating at the subscriber unit and being received by the BTS (also known as the reverse link), the DS-CDMA demodulator at the BTS determines the vocoding rate and sends only the number of speech bits corresponding to the determined vocoding rate within the STRAU format. A T1 link carries 24 DS0s, which currently allows for up to ninety-six 16 kbps (compressed speech) links or traffic channels using RA2 multiplexing. In a DS-CDMA system, the frames present on the T1 traveling to the same cell are generally synchronized in time to each other (except during soft handoff), because the cell air interface timing is the same for all the channels.

However, a need exists for a way to coordinate information flow through the XCs **106** and **108** during soft handoff (SHO) in the 16 kbps STRAU links at the boundary locations or seams **200** (shown in FIG. **2**). This need is fulfilled by Communication Across Regional Entity (CARE) links as described below. These CARE links, as shown in phantom line **101**, couple two XCs together so that information can readily be transferred between them. It will appreciated by those skilled in the art that these CARE links may be provided through links between the XCs as routed through one or more MSCs **112** and **122**, an MM **120**, and/or the PSTN **124**. Whenever a XCDR is connected to a cell (e.g., cell 1 associated with BTS **116**) located near a seam **200**, the potential situation exists for a link being required to another XC **108** connected to a neighbor cell (cell 4 associated with BTS **118**). If a subscriber unit reports a strong pilot in a cell (e.g., cell 4) across the seam **200**, then the XCs **106** and **108** coordinate and arbitrate the soft handoff across their CARE link boundary using a segmented XCDR configuration. The XCDR may eventually be handed over to another resource more local to the subscriber current location. CARE links use STRAU to frame the data for communication between XC's and a CAP interface for communication to the higher (MM) entity.

The source XCDR (SXCDR) associated with BTS **116** in XC system **106** terminates the traffic channel while in SHO. The destination XCDR (DXCDR) associated with BTS **118** in XC **108** routes the physical link that it receives from its BTS through a CARE link to the SXCDR in a bypass mode. In parallel, the DXCDR determines proper time adjustment in preparation for assuming responsibility if the

subscriber unit moves entirely into its cell. The SXCDR transmits the voice and adjusts its transcoding window for proper delay minimization using feedback through the STRAU from the BTS **118**. The selector to the DXCDR informs the destination transcoder to time adjust its window by monitoring the time alignment information in the STRAU from the BTS **118**. In CARE links, added delay occurs for the other, passive XCDR, path which routes STRAU in a bypass mode. If the MSC **112** or **122** is employed to route STRAU between the XC's **106** and **108**, then additional delay may be added to the CARE link. Therefore, any slight discrepancy in the second BTS Span time must be accommodated. This is preferably done at the SXCDR and is automatically controlled by a feedback time alignment protocol. The added delay results in the SXCDR advancing its transmission to its BTS's.

Since the MSC may be set up in a three party conference circuit configuration, the vocoder chip must be programmed to send muted PCM speech frames. The selecting function on the two links during SHO is performed at the SXCDR. Physically the sub-systems may be connected with a 1.544 kbps link between the two XC's **106** and **108**. Alternatively, the connection may be built into an open interface standard such as the Motorola proposed "A+ interface" or other communication protocol standards such as IS-41 (published by the Telecommunications Industries Association (TIA), 2001 Pennsylvania Ave., N.W., Washington, D.C. 20006), by using the MSC **112** or **122** to route to the other XC **108**. These connections at the MSC **112** or **122** could be nailed or a packet scheme may be used.

The DXCDR during the CARE link process monitors the STRAU information at its selector, while also monitoring STRAU framing. It reads the data from the BTS and immediately writes the data towards the SXCDR as long as the in-band control bit within the STRAU framing is set active for bypass mode. The SXCDR maintains active control of the traffic channel until the MM **114** orders it to pass control to the DXCDR, which occurs when the subscriber unit moves singularly into the new XC **108** region coverage area. Active control means that a XCDR performs selecting, transcoding, and subscriber unit call processing. The SXCDR always passes active control of the traffic channel over to the DXCDR in the same known state. The SXCDR continues the voice decoding while the DXCDR starts for

synchronization purposes. The MSC **112** or **122**, which is functioning in three party conference mode, must also know if its resources are in SHO in order to determine blocking.

A typical call flow diagram is shown in FIGs. **3** and **4** depicting the messaging necessary for adding and dropping BTS's across regional entities. It will be appreciated by those skilled in the art that these procedures also may be extended to scenarios involving handoffs to more separated equipment, i.e., a different MM as well as other XCs.

Referring now more particularly to FIG. **3**, a communication flow diagram for adding a handoff setup is shown. A subscriber unit or mobile station (MS) sends a Pilot Strength Measurement Message (PSMM) to the BTS which passed the PSMM to the SXCDR. If the PSMM indicates that another BTS pilot signal is greater than a predetermined threshold, then a HO is recognized and indicated to the MM. The MM sets up a CARE link between the SXCDR and the DXCDR. This CARE link is confirmed by the generic processor (GPROC) at each transcoder rack. In addition, the MM requests a three party conference from the MSC or switch (SW) entity to smooth out the audio quality of the call being handed off. The SW acknowledges this request. Subsequently, the MM sends a SHO bypass request to the DXCDR on the CARE link. This SHO bypass request is acknowledged by the DXCDR on the CARE link . At the same time or any time thereafter, the MM also requests a HO channel (i.e., a radio channel) to be assigned by the destination transmitter/receiver (DXCVR) apparatus. The DXCVR acknowledges the assignment of a communication resource (i.e., radio channel). Once all of this is completed, the MM initiates handoff at the SXCDR. The SXCDR begins to transmit the subscriber communication information on the CARE link to the DXCDR as well as monitor the subscriber communication information itself. The SXCDR then sends a handoff direction message to the MS. When the MS is acquired by the DXCVR, the MS sends a handoff completion message to the SXCDR. Once the SXCDR receives the handoff complete message, the SXCDR notifies the MM that the HO was successful. At this point, the MS is in a SHO state and is communicating with both the SXCDR and the DXCDR as well as the SXCVR and the DXCVR.

Referring now more particularly to FIG. 4, a communication flow diagram for a dropping handoff setup is shown. The MS sends a PSMM to the SXCDR which indicates that the source BTS has a pilot signal strength below a predetermined threshold. If the pilot signal strength remains below the predetermined threshold for a set time period (at the expiration of a timer), then the SXCDR sends a drop SHO request to the MM. The MM then sends a vocoder/control release message to the SXCDR. Subsequently, the SXCDR sends in the CARE link a start vocoding and communication controlling message to the DXCDR. This can be accomplished by the SXCDR with in-band signaling in the STRAU for a synchronized swap of XCDR control. The DXCDR acknowledges swapping of the control to the SXCDR. As a result, the SXCDR notifies the MM that SHO Control has begun by the DXCDR and requests that SHO control be released at the MM from the SXCDR. In addition, the SXCDR preferably will send a mute audio signal to the SW to smooth any possible audio hole created by a transcoder handoff. Subsequently, the MM sends a HO direction message to the DXCDR which passes the message to the MS. The MS responds with a confirmation of the HO to the DXCDR and the DXCDR passes the HO successful message to the MM. At approximately the same time, the SXCDR releases the radio channel at the SXCVR. In addition, the MM releases the three party conference circuit at the SW. The SW acknowledges the release of the three party conference. The MM then places the SXCDR in standby mode which is confirmed by the SXCDR which completes the dropping of the SXCDR from the SHO communication state.

In an alternative preferred embodiment, SHO may be extended by connecting BTS's which are near transcoder seams to two XC sub-systems (e.g., XC **108** and **132**). Soft handoff between BTS **126** and BTS **134** can be accomplished through the use of CARE signaling techniques. Normally, a handoff between BTS **126** and BTS **134** would be required to be a hard handoff (i.e., without communication between transcoders). But, with this configuration, since BTS **126** and BTS **134** are both connected to XC-C **132** by dedicated spans **128** and **136**, respectively, a soft handoff can occur between these cells. It can employ the same CARE signaling with the slightly different physical linking scheme. This scheme minimizes the bypass mode bandwidth

requirement during CARE signaling at the expense of having redundant dedicated spans **128** and **130** to multiple transcoders per BTS.

The principles described herein can be summarized as follows. A radio communication system (shown in FIG. **1** preferably includes a first **106** and a second **108** transcoder which are operatively coupled to a first **116** and a second **118** base site communication unit, respectively. In addition, a mobile communication unit (not shown) which is operating in the system requests to enter soft handoff mode with the first **116** and the second **118** base site communication units. A method for performing the soft handoff is provided which includes establishing a transcoder-base site interface link between the second base site **118** and the second transcoder **108**. In addition, the second transcoder **108** is configured to operate in a bypass mode such that the second transcoder **108** relays information on the transcoder-base site interface link through a CARE-Link in conjunction with a CARE-Control-Link between the first **106** and the second **108** transcoder. In the preferred embodiment, the second transcoder **108** synchronizes the CARE- Link to the transcoder-base site interface link such that a lower delay occurs for communications relayed between the two links. Finally, the first transcoder **106** is configured to operate in soft handoff mode by relaying information on the CARE-Link which is controlled by the CARE-Control-Link. In an alternative embodiment, the second transcoder **108** can only operate in the bypass mode to relay information within the transcoder-base site interface link through a CARE-Link and monitor control messages on the CARE-Control-Link between the first transcoder **106** and the second transcoder **108**.

To achieve a transcoder operation handoff (i.e. a SHO), control information is passed to the second transcoder **108** which indicates that the second transcoder **108** should take over communications with the mobile communication unit, in response to a determination that communications with the first base site **116** should be eliminated. The second transcoder **108** monitors a communication link for subsequent control information. The particular communication link which is monitored may be the CARE-Link, CARE-Control-Link, or the transcoder-base site interface link. Finally, the second transcoder **108** takes control of the communications with the mobile communication unit, in response to the second transcoder **108** receiving control information

in the monitored communication link. This step of taking control may also include configuring the first transcoder **106** to operate in a bypass mode such that the first transcoder **106** relays information on a transcoder-base site interface link between the first base site **116** and the first transcoder **106** through the CARE-Link as well as setting up the first transcoder to monitor the CARE-Control-Link for subsequent control signals. This monitoring may consist of either detecting a change in the content of the control information or waiting for a time out event. Further the step of taking control may include the second transcoder **108** acknowledging on the CARE-Control-Link it's having taken control of the communications with the mobile communication unit. At the same time, the first transcoder **106** may be released from communications with the mobile communication unit.

In the alternative embodiment, the second transcoder **108** switches transcoding operations to another transcoder capable of encoding and decoding voice information.

Alternatively, the transcoder operation handoff may be aborted by passing control information to the second transcoder **108** which indicates that the second transcoder **108** should terminate communications with the mobile communication unit, in response to a determination that communications with the second base site **118** should be eliminated. In addition, the second transcoder **108** monitors a communication link for control information. The particular communication link which is monitored may be the CARE-Link, CARE-Control-Link, or the transcoder-base site interface link. Finally, the second transcoder **108** is released from communications with the mobile communication unit, in response to the second transcoder **108** receiving control information in the monitored communication link.

It will be appreciated by those skilled in the art that these steps of passing transcoder operations are accomplished through the CARE-Link and the CARE-Control-Link which each comprise a logical connection between the first **106** and the second **108** transcoder. The logical connection may be formed by an operative coupling between at least two of the following system entities including: the first transcoder **106**, the second transcoder **108**, a first mobility manager **114**, a second mobility manager **120**, a first base site controller **116**, a second base site controller **118**, a first communication network switch **112**, a

second communication network switch **122**, a location register, and a public switched telephone network **124**.

Also, it will be appreciated by those skilled in the art that the SHO may include enabling a three party conference circuit operatively coupled to pulse code modulated information signals associated with the first **106** and the second **108** transcoder, respectively, as well as at least one communication network switch **112**. Along with this enabling step, an audio mute should be provided to the three party conference circuit during the call handoff to reduce spurious audio noises in the call.

Further, it will be appreciated by those skilled in the art that, although a linked-communication mode of a handoff between regional entities is specifically described, the principles contained herein may be readily applied to other linked-communications including diversity combining and communication link encryption without departing from the scope and spirit of the present invention.

Although the invention has been described and illustrated with a certain degree of particularity, it is understood that the present disclosure of embodiments has been made by way of example only and that numerous changes in the arrangement and combination of parts as well as steps may be resorted to by those skilled in the art without departing from the spirit and scope of the invention as claimed. For example, the network device operations have been described in the context of a transcoder handoff operation. However, it will be appreciated by those skilled in the art that the present invention teachings can be readily adapted for use with other types of network device operations such as diversity combining and communication link encryption processes. In addition, the source and target network devices may be devices other than a transcoder such as a mobility manager, a base site controller, a communication network switch, or a location register. Finally, the radio communication channel could alternatively be an electronic data bus, wireline, optical fiber link, satellite link, or any other type of communication channel.

Claims

What is claimed is:

1. In a radio communication system having a first and a second transcoder, a first and a second base site communication unit operatively coupled to the first and the second transcoder, respectively, and a mobile communication unit requesting to enter a linked-communication mode with the first and the second base site communication units, a method for performing a linked-communication, comprising:
   (a) establishing a transcoder-base site interface link between the second base site and the second transcoder at the second transcoder;
   (b) configuring the second transcoder to operate in a bypass mode such that the second transcoder relays information within the transcoder-base site interface link through a communication across regional entity (CARE)-Link in conjunction with a CARE-Control-Link between the first and the second transcoder; and
   (c) configuring the first transcoder to operate in linked-communication mode by relaying information within the CARE-Link which is controlled by the CARE-Control-Link.

2. The method of claim 1 further comprising the step of synchronizing the CARE-Link to an established transcoder-base site interface link between the first base site and the first transcoder.

3. The method of claim 1 further comprising the steps of:
   (a) passing control information to the second transcoder which indicates that the second transcoder should take over communications with the mobile communication unit, in response to a determination that communications with the first base site should be eliminated;
   (b) monitoring a communication link at the second transcoder for control information, the communication link being

selected from the group consisting of the CARE-Link, CARE-Control-Link, and the transcoder-base site interface link; and

(c) taking control of the communications with the mobile communication unit in the second transcoder, in response to the second transcoder receiving control information in the monitored communication link.

4. The method of claim 3 wherein handoff mode comprises configuring the first transcoder to operate in a bypass mode such that the first transcoder relays information on a transcoder-base site interface link between the first base site and the first transcoder at the first transcoder through the CARE-Link and monitors the CARE-Control-Link.

5. The method of claim 3 wherein handoff mode comprises enabling a three party conference circuit operatively coupled to pulse code modulated information signals associated with the first and the second transcoder, respectively, as well as at least one communication network switch.

6. The method of claim 5 wherein the transcoder configured in a bypass mode provides an audio mute to the three party conference circuit.

7. The method of claim 1 further comprising the steps of:

(a) passing control information to the second transcoder which indicates that the second transcoder should terminate communications with the mobile communication unit, in response to a determination that communications with the second base site should be eliminated;

(b) monitoring a communication link at the second transcoder for control information, the communication link being selected from the group consisting of the CARE-Link, CARE-Control-Link, and the transcoder-base site interface link; and

(c) releasing the second transcoder from communications with the mobile communication unit, in response to the second transcoder receiving control information in the monitored communication link.

8. A source transcoder operatively coupled to a base site communication unit for use in a radio communication system which enables the performing of a linked-communication of communications with a mobile communication unit between the source transcoder and a target transcoder operatively coupled to another base site communication unit, the source transcoder comprising:

(a) notifying means for notifying the target transcoder to operate in a bypass mode such that the target transcoder relays information within a transcoder-base site interface link between the other base site and the target transcoder through a CARE-Link in conjunction with a CARE-Control-Link between the source transcoder and the target transcoder; and

(b) configuration means, operatively coupled to the notifying means, for configuring the source transcoder to operate in linked-communication mode by relaying information within the CARE-Link which is controlled by the CARE-Control-Link.

9. The source transcoder of claim 8 wherein the CARE-Link and the CARE-Control-Link each comprise a logical connection between the source and the target transcoder, the logical connection being formed by an operative coupling between at least two of the following system entities selected from the group consisting of the source transcoder, the target transcoder, a first mobility manager, a second mobility manager, a first communication network switch, a second communication network switch, and a public switched telephone network.

10. A target transcoder operatively coupled to a base site communication unit for use in a radio communication system

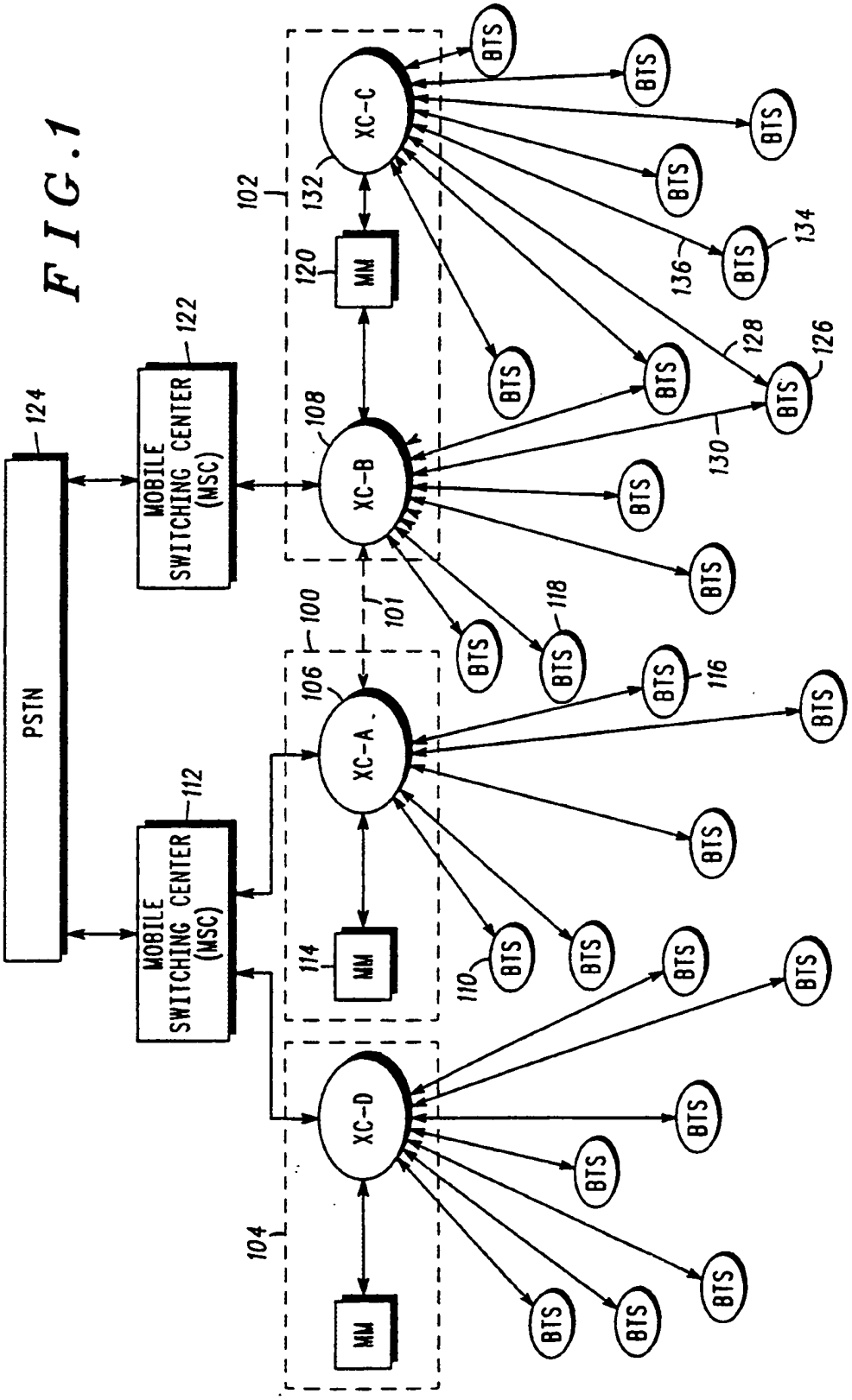
which enables the performing of a linked-communication of communications with a mobile communication unit between the target transcoder and a source transcoder operatively coupled to another base site communication unit, the target transcoder comprising:

(a) link enabling means for establishing a transcoder-base site interface link between the base site and the target transcoder; and

(b) configuring means, operatively coupled to the link enabling means, for configuring the target transcoder to operate in a bypass mode such that the target transcoder relays information within the transcoder-base site interface link through a CARE-Link in conjunction with a CARE-Control-Link between the source transcoder and the target transcoder.

11. The target transcoder of claim 10 wherein the CARE-Link and the CARE-Control-Link each comprise a logical connection between the source and the target transcoder, the logical connection being formed by an operative coupling between at least two of the following system entities selected from the group consisting of the source transcoder, the target transcoder, a first mobility manager, a second mobility manager, a first communication network switch, a second communication network switch, and a public switched telephone network.

FIG. 1


PSTN
124
MOBILE SWITCHING CENTER (MSC)
122
MOBILE SWITCHING CENTER (MSC)
112
XC-A
106
XC-B
108
XC-C
132
XC-D
104
MM
120
MM
114
MM
102
100
101
BTS
110
116
118
126
128
130
134
136

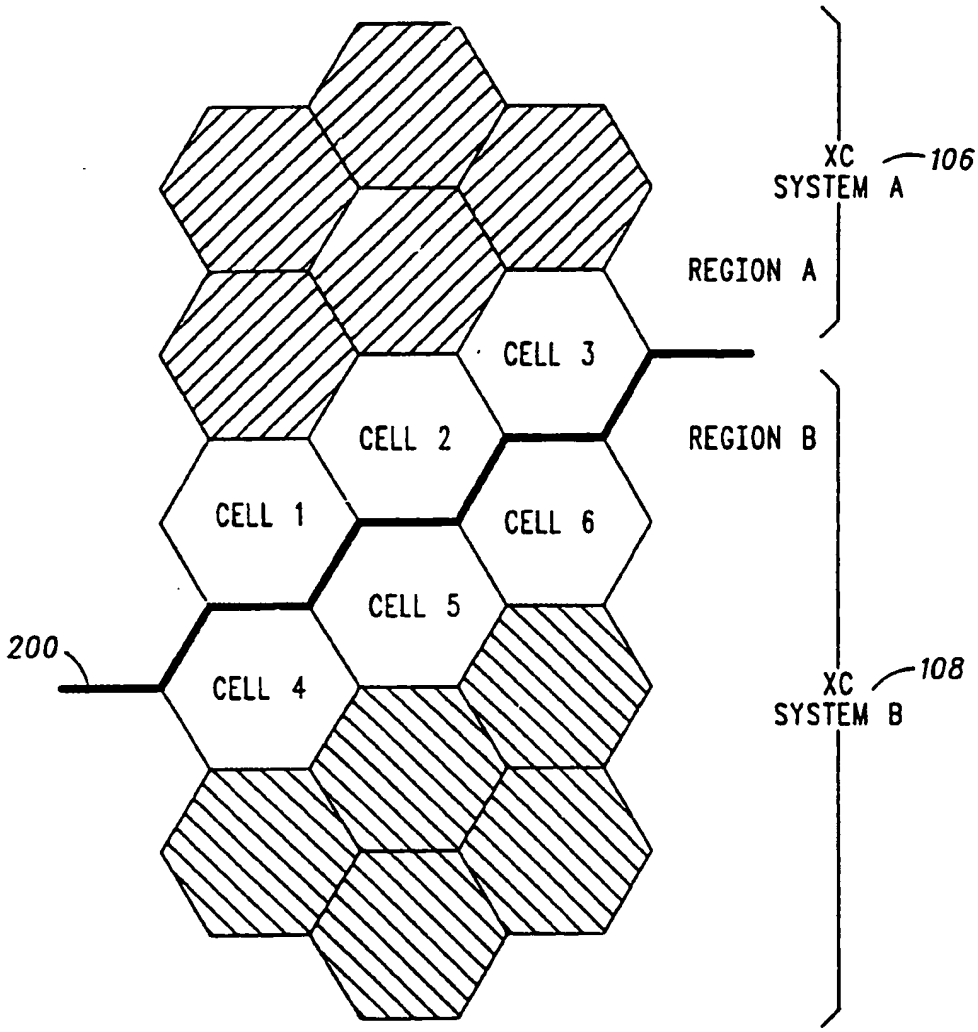

XC
SYSTEM A
106
REGION A
CELL 3
CELL 2
REGION B
CELL 1
CELL 6
CELL 5
200
CELL 4
XC
SYSTEM B
108

FIG. 2

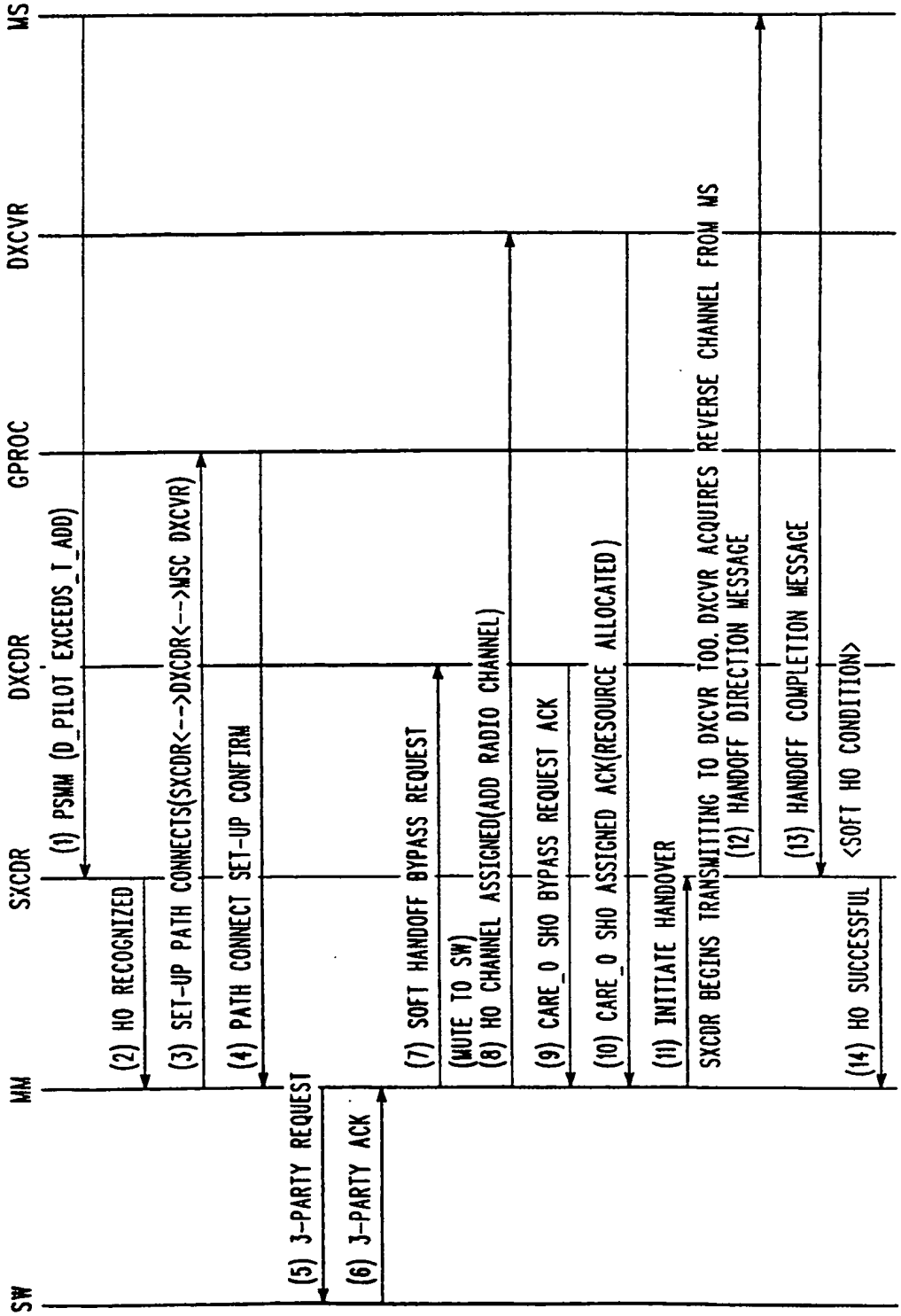

SW
MM
SXCDR
DXCDR
GPROC
DXCVR
MS
(1) PSMM (D_PILOT EXCEEDS T_ADD)
(2) HO RECOGNIZED
(3) SET-UP PATH CONNECTS(SXCDR<-->DXCDR<-->MSC DXCVR)
(4) PATH CONNECT SET-UP CONFIRM
(5) 3-PARTY REQUEST
(6) 3-PARTY ACK
(7) SOFT HANDOFF BYPASS REQUEST
(MUTE TO SW)
(8) HO CHANNEL ASSIGNED(ADD RADIO CHANNEL)
(9) CARE_O SHO BYPASS REQUEST ACK
(10) CARE_O SHO ASSIGNED ACK(RESOURCE ALLOCATED)
(11) INITIATE HANDOVER
SXCDR BEGINS TRANSMITTING TO DXCVR TOO. DXCVR ACQUIRES REVERSE CHANNEL FROM MS
(12) HANDOFF DIRECTION MESSAGE
(13) HANDOFF COMPLETION MESSAGE
(14) HO SUCCESSFUL
<SOFT HO CONDITION>

FIG. 3

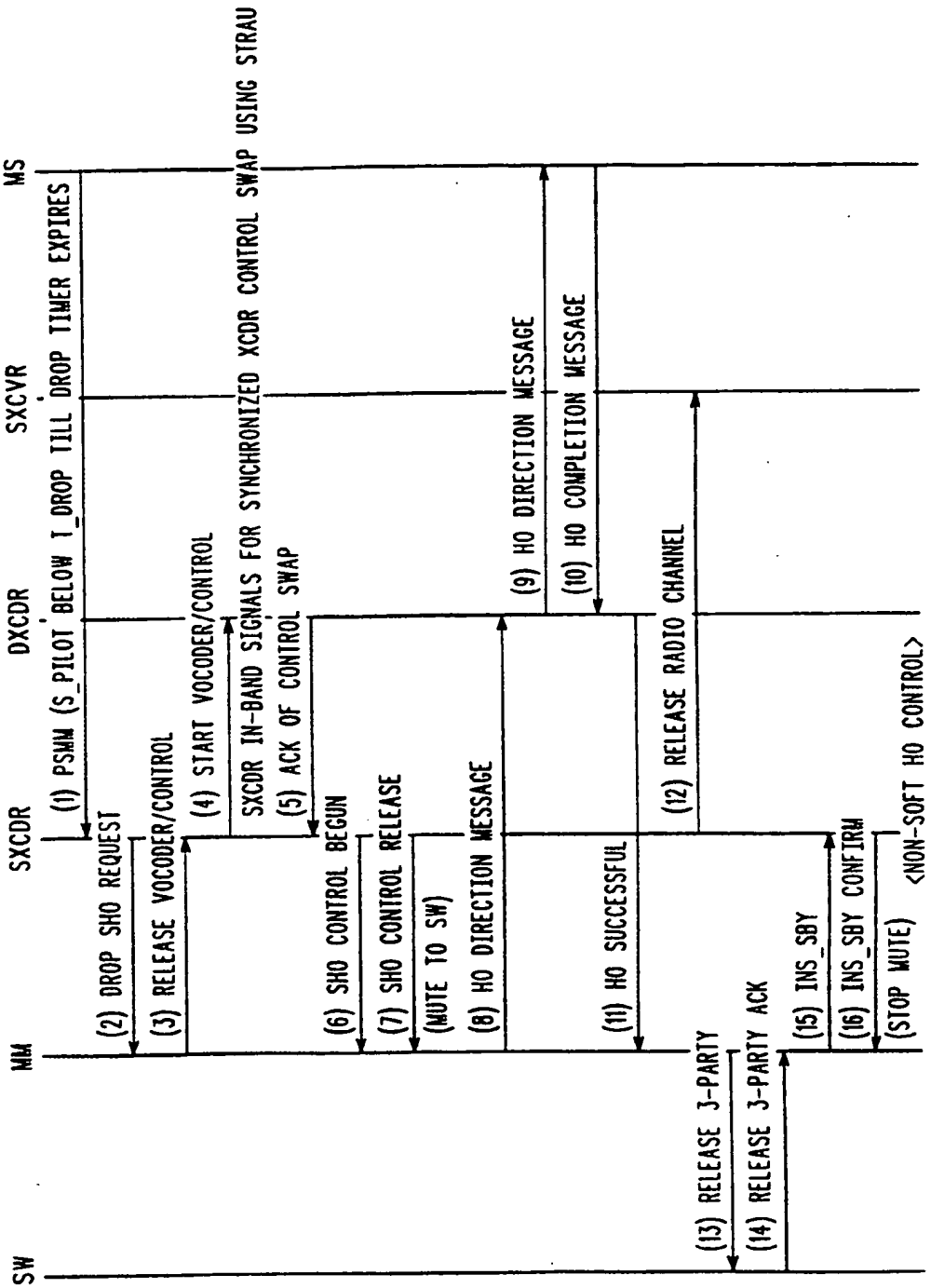

MM
SXCDR
DXCDR
SXCVR
MS
SW
(1) PSMM (S_PILOT BELOW T_DROP TILL DROP TIMER EXPIRES
(2) DROP SHO REQUEST
(3) RELEASE VOCODER/CONTROL
(4) START VOCODER/CONTROL
SXCDR IN-BAND SIGNALS FOR SYNCHRONIZED XCDR CONTROL SWAP USING STRAU
(5) ACK OF CONTROL SWAP
(6) SHO CONTROL BEGUN
(7) SHO CONTROL RELEASE
(MUTE TO SW)
(8) HO DIRECTION MESSAGE
(9) HO DIRECTION MESSAGE
(10) HO COMPLETION MESSAGE
(11) HO SUCCESSFUL
(12) RELEASE RADIO CHANNEL
(13) RELEASE 3-PARTY
(14) RELEASE 3-PARTY ACK
(15) INS_SBY
(16) INS_SBY CONFIRM
(STOP MUTE)
<NON-SOFT HO CONTROL>

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/12419

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H 04 Q 7/24
US CL :379/58

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 379/58, 56, 59, 60; 370/32.1, 60, 94.1, 95.1; 375/40; 455/33.1, 56.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Please See Extra Sheet.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,398,063 (HASS et al) 09 August 1983, figure 1, #12, 13, MSA1, MSA2.	1-11
A	US, A, 5,090,050 (HEFFERNAN) 18 February 1992	1-11
A	US, A, 5,226,071 (BOLLIGER, et al) 06 July 1993	1-11
Y,P	US, A, 5,278,892 (BOLLIGER, et al) 11 January 1994, figure 2, #207, 209, figure 3, #244, figures 27 and 28, #MASTER CELL, 244, SLAVE CELL.	1-11
A,P	US, A, 5,309,501 (KOZIK, et al) 03 May 1994	1-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 21 JANUARY 1995	Date of mailing of the international search report 28 MAR 1995
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer WILLIAM D. CUMMING Telephone No. (703) 305-4394

Form PCT/ISA/210 (second sheet)(July 1992)*

B. FIELDS SEARCHED
Electronic data bases consulted (Name of data base and where practicable terms used):

ABS, search terms: (radio or cellualr or mobile or cordless or wireless)(w)(telephone or phone), radiotelephone, network or system, mode, source, home, first(w)(form or type), particular time, bypassing, target, visiting, incoming information.

INVITATION TO REQUEST RECTIFICATION

International application No.
PCT/US94/12419

Applicant is invited to correct the obvious errors noted below:

1. Figure 2 is not designated by a legend such as "Prior Art".
2. The terms "handoff between regional entities mode", "diversity combining mode", "communication link encryption mode", "time out event", "diversity mode" do not appear in the specification, hence, fail to provide clear support for the claim terminology.
3. To insure proper considerstion, Applicant should provide the Examiner with a copy of the publication cited in the specification because it is not readily available to the Examiner.